

Results of Surgical Treatment of Chronic Pancreatitis

Report of 142 Cases

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The authors report on 142 patients treated surgically for chronic pancreatitis. They had an average age of 43.5; 34.5% were calcific; 62.7% were alcoholics; 28.9% had cysts; 19% had diabetes; 16.9% had steatorrhea; and all had pain. A follow-up of 55 patients undergoing pancreaticojejunostomy showed that, 4–21 years following operation 16 had marked improvement, 11 had some relief, four were not relieved from pain, and 24 had died, three within one month postoperatively and 21 later. Eighty to ninety-five per cent pancreatectomy was more effective in relieving pain in the 9 patients subjected to this type of resection than was the 50–80% pancreatic resection used in 16 patients. Pancreaticoduodenectomy was of some value in three of five patients so operated. Celiac ganglionectomy, used in 22 patients, and sphincteroplasty, used in 35 patients, were less effective in relieving symptoms than the other procedures.

THE MORTALITY AND MORBIDITY from chronic pancreatitis remains high in spite of the development of a number of types of operative procedures to treat the complications of this disease. This is partly because chronic pancreatitis is in most instances only one of several complications of chronic alcoholism, and that the other complications are unaffected by our operative procedures. The main effect, that of relieving pain produced by the pancreatitis, does not affect the hepatic, gastric, or other diseases associated with alcoholism. The purpose of this study is to review the experience with these procedures as carried out by one surgeon in the Pacific Northwest of the United States, and to compare the relative value of pancreatic resection as opposed to pancreaticojejunostomy and celiac ganglionectomy. We would, at the same time, like to show that cholecystectomy accompanied by sphincteroplasty is of no value in the treatment of this disease process. We would also like to point out what factors are useful in selecting a specific operation for a given patient, and compare the present series to prior ones.

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Materials and Methods

The patients in this series were selected from among 275 patients with acute and chronic pancreatitis personally seen, treated, and followed by the senior author from 1953 to 1971. One hundred forty-two of these patients were classified as having chronic pancreatitis according to the criteria outlined in the Symposium held in Marseilles in 1965^{15a}. About 60% of these patients were proven chronic alcoholics. All had had continuous abdominal pain for two or more years, and in each instance the diagnosis had been confirmed by operative biopsy, by gross changes in the pancreas as seen at surgery, and/or by autopsy. Only 85 of the 142 patients with chronic pancreatitis had a direct procedure performed on the pancreas such as resection or pancreaticojejunostomy, 22 additional patients were subjected to celiac ganglionectomy, and 35 others had their common bile duct drained by sphincteroplasty. Of the 85 patients who had an operative procedure carried out directly on the pancreas, 55 had a latero-lateral pancreaticojejunostomy 10 cm in length or greater, of the type which has been described by ourselves and others on several prior occasions.^{2,8,13,18,20,21–23} The short openings in the pancreas described by Duval,^{3,4} Leger,^{14,15} Mercadier,¹⁶ and others^{9,10,12,13,18} were not used in the patients in this series, nor was the operative procedure described by Gillesby and Puestow, which consisted of a finger-in-glove invagination of the pancreas to the left of the aorta into a jejunal loop, because these procedures have previously been shown to be less satisfactory than the side-to-side procedure with a longer opening. Thirty further patients had a 40–95% pancreatectomy, either as a primary procedure in 26 cases, or after failure of a pancreatico-

jejunostomy in four further patients. Of the patients who were resected, nine had an 80–95% left-to-right pancreatectomy, five had a pancreaticoduodenectomy (Whipple operation), and the remaining 16 patients had a 40–80% left-to-right resection. Four of the patients resected had a celiac ganglionectomy performed as well. Celiac ganglionectomy alone was carried out in 18 further patients.

Of the 12 patients subjected to stomach operations, eight had gastric resections, and four had a vagotomy and pyloroplasty. The stomach operations are not discussed separately herein because they did not relieve symptoms and because, with two exceptions, they were being used to treat ulcer rather than pancreatic disease. In the two instances where the operation was used as a treatment for chronic pancreatitis, the procedure of gastric resection was completely ineffective.

This study is a review of 142 individuals subjected to pancreaticojejunostomy, pancreatic resection, celiac ganglionectomy or sphincteroplasty. Most of these patients had had other operative procedures as well. We will not discuss the effect of procedures not mentioned herein on these patients.

Pre- and Postoperative Evaluation

The routine laboratory studies carried out consisted of complete hematological screening, measurement of amylase, lipase, and liver enzymes as well as measurement of blood urea, nitrogen, and creatinine. Glucose tolerance curves and three day, 80 g fecal fat balances were carried out as indicated. All patients had at least one upper gastrointestinal series, gallbladder series, and intravenous cholangiograms as well as plain films of the abdomen. Gallstones were present in only eight patients. Secretin tests were not routinely performed because the disease was so advanced in these patients that this test was considered to be redundant. Isotope scanning using selenomethianine was not considered a helpful diagnostic aid in these patients. Diagnostic ultrasound and endoscopic retrograde cholangiography were not used in this series because they were not introduced into this community until 1973, two years after the termination of the period of this study. Patients were not subjected to surgery until they had had a trial of complete abstinence from alcohol for three months or longer. A thorough evaluation of the patient's personality, home and work environment were also reviewed in order to ascertain whether reduction of tensions in this area could help the patients' symptoms as well as to help them stop drinking. Patients have been followed-up at least yearly, and more frequently if possible. The patients were classified according to three categories.

Category A. Those who improved during the post-operative period, or who were free of symptoms of pancreatitis, and who were able to work.

Category B. Patients who were improved, but had mild residual symptoms attributable to pancreatitis.

Category C. Patients who did not improve post-operatively and who continued to have symptoms related to their disease.

We also attempted to correlate the levels of serum amylase, liver function tests, diabetes, degree of steatorrhea, pancreatic calcification, alcohol consumption, duct dilatation, and postoperative personality with the survival and quality of life following each operative procedure.

Operative Evaluation

In each instance the pancreas, upper abdomen, and entire abdominal cavity were examined after completely opening the lesser sac by dividing the gastocolic omentum. The pancreas was assessed by mobilization of the head of the pancreas together with the lower end of the bile duct, direct palpation of the pancreatic ducts from the front of the gland, operative pancreatography either by direct puncture of a palpably dilated main pancreatic duct, transduodenal cannulation of the pancreatic duct with or without performance of sphincteroplasty, and cannulation of the left end of the pancreatic duct after resection of the spleen and a small amount of tail, or by direct injection of a pancreatic cyst. Direct palpation of an enlarged pancreatic duct and demonstration of dilatation of the ductal system by x-rays were major factors in influencing the choice of operative procedure.

Results

Preoperative Testing

We were interested to find that neither the biochemical nor the hematological laboratory studies showed any variation outside of the normal range in two-thirds of the patients. An elevated serum amylase was noted in only 23 patients, and abnormalities in hepatic function were demonstrated by liver function tests in only 17 instances. An additional ten patients with otherwise normal liver function tests had periodic moderate elevation of alkaline phosphatase thought to be on the basis of compression of the distal bile duct. Pancreatic calcification was seen in the plain films of the abdomen in only 52 out of the 145 patients (Table 1). This was considered, when present, to be the single most useful finding in this series. Twenty-five of the patients with calcification were known to have an alcohol intake of in excess of 150 g/day.

There was laboratory evidence of jaundice due to

TABLE 1. Preoperative Data on Present Series of 142 Patients

Type of Procedure	No. of Cases	M	F	Mean Age	Calcific	Alcoholism	Cysts	Diabetes	Steatorrhea	Cancer
Pancreaticojejunostomy	55	38	17	45.2	43.6% (24)	67.3% (37)	21.8% (29)	16.4% (9)	12.7% (7)	16.4% (9)
80–95% Resection	9	7	2	35.9	40.0% (4)	60.0% (6)	44.4% (4)	77.0% (7)	55.5% (5)	11.1% (1)
Partial (40–80%) pancreatectomy	16	6	10	41.5	33.3% (5)	62.5% (10)	25.0% (4)	25.0% (4)	18.7% (3)	— (0)
Pancreaticoduodenectomy	5	2	3	46.0	40.0% (2)	40.0% (2)	20.0% (1)	20.0% (1)	20.0% (1)	40.0% (2)
Celiac ganglionectomy	22	12	10	42.5	24.0% (6)	24.0% (6)	13.6% (3)	9.1% (2)	9.1% (2)	9.1% (2)
Sphincter operations	35	18	17	47.4	23.0% (8)	80.0% (28)	— (0)	11.4% (4)	17.1% (6)	— (0)
Total	142	83	59	43.5	34.5% (49)	62.7% (89)	28.9% (41)	19.0% (27)	16.9% (24)	9.8% (14)

presumed compression of the distal intrapancreatic common bile duct in 20 patients, diabetes in 29 patients, steatorrhea in 27 patients (Table 1). About half of the patients had lost up to 10% of body weight. A significant weight loss due to steatorrhea and/or a severe anorexia because of abdominal pain requiring hospital admission was present in only four instances. The follow-up period ranged from two to 14 years (with a mean of a follow-up period of 8.0 years). All operations in this series were carried out by or with the senior author. Details of surgical techniques for each of these procedures has been described in prior publications.^{21–23}

Results of Individual Operations

Pancreaticojejunostomy

Twenty-seven of the 55 patients in this group were still alive at the time of this study. Sixteen were placed into group A, seven into group B, and four patients had not improved and were classified in category C. There were two deaths within one month of operation. One 75-year-old woman died of peritonitis and septicemia following biliary decompression for secondary cholangitis. A 45-year-old man died of myocardial infarction 25 days after surgery. Twenty-one further patients died one to nine years following their surgical procedure. Nine of these patients were eventually found to have carcinoma of the pancreas at autopsy which had not been recognized at the time of surgery. In each instance an operative biopsy had failed to reveal any evidence of malignancy. The remaining 12 late deaths occurred one to nine years later (with a mean survival time of four years). The quality of life at the time of death was equivalent to category A in three instances and to category B in six instances. Three patients were not improved prior to death. The causes of

death in these 12 patients were related to complications of pancreatitis in 2 patients; pancreatic dysfunction and cirrhosis in 6 patients; myocardial infarction in one patient; cerebral vascular accident in one instance; chronic obstructive lung disease in one patient; and suicide in one patient. Most of the nine patients with carcinoma were relieved of pain immediately following pancreaticojejunostomy, but deteriorated rapidly. One of the nine lived for two years after surgery, but the remaining eight individuals died within six months.

Survival Data

If one excluded the nine patients dying from carcinoma of the pancreas we note that there was a very rapid early decline in survival rate after the eighteenth postoperative month, but from the eighth postoperative year onward the rate of survival remained stable and paralleled the expected survival for the United States population of this age in 1974. While abstinence from alcohol did not appear to affect survival, continued postoperative drinking causes a significant decrease of survival rate as opposed to that found in patients who did not drink. The cause of death at autopsy in patients who continued to drink was usually attributed to hepatocellular damage, particularly cirrhosis, rather than continued pancreatitis (Table 2).

Pancreatic Resection

Of the 30 patients who had some form of pancreatic resection, nine patients had an 80–95% right pancreatectomy with removal of the uncinata process, five had pancreaticoduodenectomy, and 50–80% resection was carried out in 16 further instances. An additional jejunal anastomosis to the divided pancreatic stump was carried out in nine of the latter 16 patients. The pan-

creas was attached to the stomach in two further instances. Twenty-two of these 30 patients had prior surgery for pancreatitis: a partial gastrectomy had been carried out in five patients; cholecystectomy in 11 patients; and a sphincter-cutting procedure in 13 further patients. Four patients who had had a prior pancreaticojejunostomy at another institution had a 95% pancreatectomy because of persistent pain.

Eighty to Ninety-five Per Cent Pancreatectomy

This operation was carried out in nine patients or 11% of the patients undergoing a direct attack on the pancreas. In four instances a prior celiac ganglionectomy had failed to provide adequate pain relief, and in two instances a prior 50–80% pancreatectomy had failed. For this reason a further, more radical resection was undertaken. A weight loss of more than 10 kg was present in seven patients, preoperative diabetes in seven and steatorrhea in five. A somewhat higher proportion of patients had pancreatic cysts which failed to communicate with the main ductal system. The postoperative follow-up period varied from two to 13 years, with a mean of 5.3 years. One patient died in the early postoperative period because of massive hemorrhage due to bleeding from a poorly-tied branch of the portal vein. All of the other patients are still alive. While seven of the eight patients were classified initially in category A, 2 of these patients developed recurrent cysts and stones in the small residual segment four and eight years postoperatively, which necessitated performance of a pancreaticoduodenectomy to relieve symptoms. These patients continued to have problems with upper abdominal pain of undetermined origin and have been a serious management problem as far as their diabetes was concerned. The remaining patient was classified in category C and failed to improve following this procedure. The incidence of diabetes and steatorrhea was high, but both were readily treatable with appropriate antibiotic drugs and pancreatin pro-

viding that the patient did not continue to drink. Under the latter circumstances, the patients became completely unmanageable. Oral hypoglycemic agents were found to be adequate in two patients, and in five further patients, the daily insulin requirement varied from 20 to 60 units (Tables 1 and 2).

Fifty to Eighty Per Cent Pancreatectomy

This procedure was carried out in 16 of the 30 patients undergoing pancreatic resection. The main indication for this procedure was the radiological presence of a normal-appearing pancreas and pancreatic ductal system to the right of the area resected, which drained freely into the duodenum, together with marked pancreatic inflammation and fibrosis to the left of this point. The mean age of this group of patients was 41.5 years. They had less pancreatic calcification and pancreatic cysts than those patients undergoing an 80–95% resection. The incidence of alcoholism and other secondary manifestations of pancreatitis can also be seen in Table 3.

One patient, a 50-year-old woman, died on the fifteenth postoperative day with a high fever, vascular collapse, hepatic and renal failure. While permission for autopsy was refused in this individual, a liver biopsy had shown changes suggestive of halothane (Fluothane®) toxicity. Four other patients died at remote times in the postoperative period. Two had hepatic complications of chronic alcoholism, and the other two died of degenerative cardiovascular disease.

Those patients who are alive are still being followed six to 13 years after operation. Four of these patients belong in category A, 5 in category B, and one in category C. While the overall results of these procedures do not differ significantly from the results of other groups, partial pancreatectomy had the lowest incidence of patients in category A, aside from those having celiac ganglionectomy. Four of the patients who failed to improve (category B) had unstable personali-

TABLE 2. Results of Surgical Therapy

Result	Anastomosis (55 pts)	Pancreatic Resection		Pancreatico- duodenectomy (5 pts)	Celiac Ganglionectomy (22 pts)	Sphincter Operations (35 pts)
		80–95% (9 pts)	50–80% (16 pts)			
Early death (within 1 month)	3	1	1	1	0	0
Late death	21	0	4	0	2	3
Follow-up						
Marked improvement	16	7	4	1	3	5
Some relief	11	1	5	2	10	13
No help	4	0	2	1	7	12
Total	55	9	16	5	22	35
Mean length of follow-up	9.6 yrs (4–21 yrs)	5.3 yrs (4–15 yrs)	6.3 yrs (4–15 yrs)	7.8 yrs (4–17 yrs)	8.3 yrs (4–17 yrs)	8.1 yrs (5–15 yrs)

TABLE 3. Comparison between Series

Report	Present Series	Sato et al. ^{17,17a} (1975)	Way et al. ¹⁹ (1974)	Leger et al. ¹⁵ (1974)
Number of patients	142	71	57	148
Age (mean/range)	43.7/(20-71)	45.5*/(11-72)	42	39.8/(15-63)
Sex (male/female)	83/62	48/23	30/27	135/13
Alcoholism/%	95/(60%)	21(29.6%)	33/(58%)	91/(61.5%)
Calcification/%	52/(36%)	40/(56.3%)	24/(42%)	103/(68%)
Cysts/%	42/(28%)	16*/(22.5%)	16/(28%)	29/(20%)
Diabetes/%	29/(20%)	21*/(29.6%)	19/(33.3%)	19/(12.8%)
Steatorrhea/%	27/(19%)	7*(9.9%)	14/(24.7%)	47/(32%)

* Patients with fecal fat more than 10 g per day.

ties and are in the hands of psychiatrists. One other patient has recommenced heavy drinking (Tables 1 and 2).

Pancreaticoduodenectomy

This procedure has been performed in only five of the 85 patients undergoing direct operations on the pancreas. The preoperative data and results are summarized in Tables 2 and 3. One female died on the second postoperative day with jaundice and uncorrectable oliguria and hypotension. At autopsy she was found to have massive liver infarction due to a dissecting aneurysm of the common hepatic artery commencing at the point where the superior pancreaticoduodenal vessel had been ligated. Two patients operated 12 and 17 years ago were recently lost to follow-up. At their last review three years ago, one continued to have steatorrhea and varying degrees of pain (category B) and the other had recurrent severe attacks of abdominal pain unrelieved by splanchnicectomy (category C). Of the remaining 2 patients, one with pancreatic carcinoma secondary to chronic pancreatitis died about eight months postoperatively, and the other is well without evidence of symptoms four years following operation. The last individual had a cyst in the head of the pancreas which was obstructing the pancreatic duct to the left of that point, and a relatively normal body and tail of the pancreas (Tables 1 and 2).

Celiac Ganglionectomy

The technical aspects of this procedure have been previously described by the senior author.^{21,23} Aside from the fact that the ganglion was removed by retroduodenal approach in some instances, and through the twelfth rib bed in other instances, there were no basic differences in operative technique within this group. Two of these patients had had prior pancreaticojejunostomies which failed to relieve their symptoms, and in a further four patients, splanchnicectomy without celiac ganglionectomy had been carried out for diffuse pancreatic fibrosis. In five of the six patients an

80-95% pancreatectomy had to be carried out at a later date to relieve their symptoms. In the remaining 18 patients, celiac ganglionectomy was carried out at the end of an exploratory laparotomy where the diagnosis of chronic pancreatitis had been confirmed, but pancreatectomy or pancreaticojejunostomy seemed to be unsuitable or impractical because of continued psychological problems, alcoholism with severe cirrhosis of the liver, or because of medical contraindications to extensive surgery. While laboratory investigation showed no specific trends, investigations directed toward pancreatic pathology showed that the instance of cysts, diabetes, steatorrhea, and pancreatic calcification was somewhat lower than was found in the group as a whole.

Three of these patients died at remote intervals. One patient who had had a prior pancreaticoduodenectomy for what was thought to be chronic pancreatitis, failed to improve, and died one year later with disseminated carcinoma of the pancreas. The remaining two patients, one a 52-year-old woman with chronic pancreatitis and pneumonia died eight years postoperatively, and the second, a 42-year-old man died eight years postoperatively from the complications of alcoholism. Improvement lasting for two or more years following the operative procedure was noted in only three patients. Seven patients were classified in category B, and seven further patients were reported to have no improvement at follow-up and thus were classified in category C. While our early observations suggested that this might be a useful procedure,²⁵ the present study indicates that, while celiac ganglionectomy may be a useful procedure for managing patients with a limited life expectancy, such as the patient with carcinoma of the pancreas, the indications for its use to relieve pain from chronic pancreatitis seem to be limited at the present time.

Sphincteroplasty

There were 18 males and 17 females included in the 35 individuals in this group. The mean age for these patients was 47.4 as opposed to 43.5 years for the re-

mainder of the series. There were slightly more alcoholics, 28 out of 35; four patients were diabetic; six had steatorrhea; none had pancreatic cysts; but preoperative x-rays showed that calcification was present in eight instances. The amount of inflammation and fibrosis appeared to be much less in this than in the previously described groups of patients. The follow-up period ranged from five to 15 years with a mean follow-up of 8.3 years. While there were no operative deaths, there were two late deaths, one from carcinoma of the pleura one year later, and one from an unknown cause two years later. Five patients consider themselves well and symptom-free at follow-up while the remaining 28 have been classified in either category B or C. The patients undergoing this operation who have improved as a result of this type of surgery have all had isolated obstruction of the sphincter. Further direct operations on the pancreas were not performed on these patients because the symptoms and signs seen in these individuals were not great enough to warrant more radical surgery, nor did the pancreatograms performed at the time of sphincteroplasty show any need for resection or pancreaticojejunostomy. In other words, the latter procedures have been reserved for complications and severe pain not manageable by other means, as well as cysts and obstructive pancreatic ducts. This group of patients is, on the whole, passing through life with recurrent episodes of acute pancreatitis superimposed on the chronic disease (Tables 1 and 2).

Discussion

The recent increase in incidence of cases of chronic pancreatitis throughout the world is probably due to a combination of factors: the advent of diagnostic ultrasound; endoscopic retrograde pancreatography (ERCP); an increase in the number of gastroenterologists available to study patients; the new emphasis placed on searching for cases of carcinoma of the pancreas throughout the world, because of its two- to three-fold increase in incidence in the last 30 years; and to the increased use of secretin tests in many countries.^{1,7,11,24} Recent reviews on the subject of chronic pancreatitis from Switzerland and Japan indicate that the incidence of the disease in these two countries has risen about three-fold, approximately at the same rate as the instance of carcinoma.^{1,11} This finding appears to be confined only to those regions where there was a previously low reported incidence of pancreatitis. There does not appear to be the same rate of increase in the United States and France.

In a long-term follow-up of patients reported by Leger and Lenriot from Paris¹⁵ and from Way et al.¹⁹ in San Francisco, each series showed a striking similarity

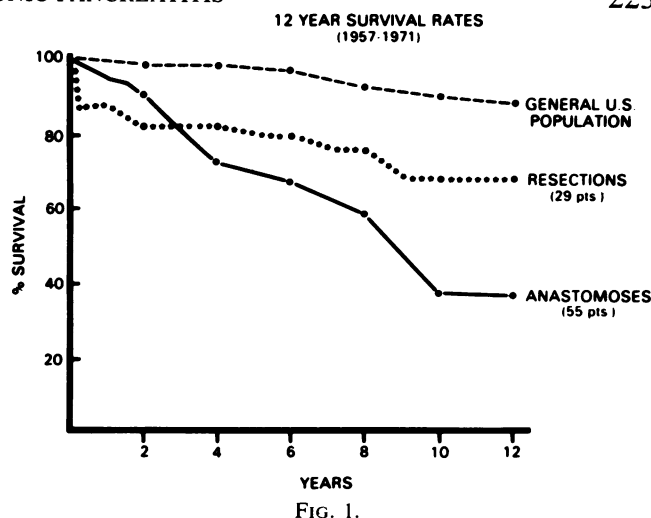
in the instance of alcoholism and mean age of patients at the time of presentation to our series. Nonetheless Sato et al.'s patients from Japan^{17,17a} were older and only a small proportion of these individuals were alcoholics. Ninety per cent of the patients studied in the French series were male, while the male to female ratios in the present series, the Japanese series, and that of Way et al. were 2:1, 2:1, and 1:1 respectively. The reason for these differences is not clear, but the prominence of males in the French group may only reflect a difference in social attitudes relative to alcohol consumption in France as opposed to some as yet obscure etiological factor (Table 3).

While there were only minor differences between the three reports as far as other preoperative data were concerned, the incidence of calcification was twice as much in the French patients, and pancreatic cysts were much more common in the American series. The quality of life among the long-term survivors also varied. If one considers all types of operation aside from celiac ganglionectomy, good results were about the same in the Seattle and Paris patients, 57 and 58% respectively. The postoperative quality of life in the California patients was much better, reported as 74%, and that in Japan as 88%. The real differences between the series are, however, difficult to assess because the series from Seattle and Paris consist essentially of a number of operations performed by one surgeon, and those of Sato and Way were collected series from several operators, and therefore are much less homogenous. The Japanese series has a relatively low percentage of alcoholics (29%). The definition of results may also be slightly different. It appears, nevertheless, that while in some centers almost 75% of patients may be relieved of pain, an average of only 60% are relieved by a given procedure in other institutions.

In approaching the pancreas at laparotomy, the surgeon has several options. The first is to treat biliary disease or localized obstruction at the sphincter. The patient may be found to have recurrent acute pancreatitis on the basis of a previously unrecognized gallstone disease. In this instance there is no need for radical, direct pancreatic surgery and cholecystectomy with removal of common bile duct stones will suffice in most instances to cure the patient. Sphincteroplasty should be reserved for those patients with a demonstrated localized, isolated sphincteric obstruction. One must not attempt to use cholecystectomy and sphincteroplasty for the treatment of true chronic pancreatitis with multiple pancreatic strictures on the basis of alcoholism. The occasional patient with a localized stricture at the sphincter of Oddi will receive only temporary relief and develop multiple strictures later if this individual is an alcoholic and continues to drink.

Nevertheless, only a small proportion of patients with chronic alcoholism accompanying chronic pancreatitis also have gallstones, so that the surgeon is not often faced with the decision as to whether to perform biliary surgery alone, or some other type of procedure in a patient with chronic pancreatitis. Choledochoduodenostomy or choledochojejunostomy may be required in some instances to decompress a distal common bile duct compressed by a chronically inflamed and/or fibrotic pancreas, but not to treat the pancreatic disease itself. Therefore, while preoperative and operative radiologic examination of the biliary tract is of interest in the care of each patient, we believe that the knowledge of the morphology of the pancreas and its ductal system are more important factors in the surgical management of chronic pancreatitis than those pertaining to the biliary tree, and that these studies should be reserved for the secondary complications of biliary tract obstruction.

Secondly, the surgeon may perform a pancreaticojejunostomy. We have been much influenced by operative x-ray studies of the pancreatic ductal system and feel that, wherever the pancreatic ductal system is dilated with a chain of small pancreatic cysts (sometimes called lakes), a pancreaticojejunostomy should be carried out. We do not feel that endoscopic retrograde pancreatography is essential in the preoperative evaluation of patients with diffuse calcification and known enlarged pancreatic ducts found by using ultrasound, because the cannulation of the ampulla is difficult in most of these patients, because the pancreatic duct is often obstructed close to the duodenum, and because there is a potential complication of infection to the left of the stricture in patients subjected to ERCP and not operated immediately. It is quite simple to do a direct puncture pancreatogram at the operating table in patients both with and without complications. We reserve ERCP for patients in which the diagnosis of chronic pancreatitis is uncertain. We believe that a latero-lateral anastomosis to the pancreas at least 10 cm in length without splenectomy will relieve most patients of pain who have diffuse ductal dilatation with or without cysts. Anastomosis to a cyst alone in patients with ductal dilatation to the right or to the left of this point does not offer permanent relief from pain unless it is accompanied by opening the duct to the right and to the left of the cyst. The shorter anastomoses recommended by others have been largely unsuccessful because of early occlusion to the right and to the left of the anastomosis. We believe that this is a more satisfactory primary procedure for patients with chronic pancreatitis because it is easier to perform, has less immediate morbidity and mortality, and because it offers about the same relief from symptoms as 50–80% resec-



tion of the pancreas from left-to-right as advocated by the group at the University of Michigan.

The third option is to resect a portion of the pancreas. We use this procedure to treat a diffusely scarred, small pancreas and where the ductal system is too small to lend itself to anastomosis, where the patient has numerous noncommunicating cysts as demonstrated by echograms, pancreatography and surgery, and where there is a localized lesion. While we have used a 50–80% pancreas resection because these patients have had very few endocrine and exocrine sequelae, we have found that patients subjected to this type of resection of the pancreas have had a high instance of recurrent pain, even where the residual pancreas appeared to be normal at the time of primary surgery. Examples of this type of patient are those who have had a large cyst removed. We have noted extensive inflammatory changes in the residual pancreatic tissue of many patients whose pancreases appeared normal at the initial procedure. For this reason, we now prefer to carry out an 80–95% removal together with the uncinate process in all patients who are going to be subjected to resectional surgery for relief of symptoms of chronic pancreatitis. Figure 1 shows the calculated survival rates for patients who have been subjected to pancreaticojejunostomy, 50–80% or 80–95% pancreatic resection, and the general population at large, matched for age at the midpoint of the time of review (1964). The early postoperative mortality is higher in those patients undergoing pancreatic resections, but, as the length of the follow-up period increases, the slope of the line for pancreatic resection more closely approximates that of the general population. One possible explanation for this result may be that the mean age of patients undergoing pancreatic resections was lower than that of the mean age undergoing pancreaticojejunostomy. The survival rate in Leger and Lenriot's series was somewhat higher in pa-

tients undergoing pancreaticojejunostomy in a group of patients averaging five years younger. The least effective procedures as far as pain relief was concerned were celiac ganglionectomy and 50–80% left-to-right pancreatectomy. It is not clear why this is so, but others have had similar results.¹⁵ We did not, however, corroborate Leger and Lenriot's conclusion that a pancreaticojejunostomy added to resection to the portal vein would improve the results, because we have not often used this approach. We have, however, had to resect a number of patients unsuccessfully treated in this manner by others.

We have used pancreaticoduodenectomy least of the three types of resections carried out in this series, using it only in five instances. Of the three patients who are surviving, all of them continued to have symptoms of pain. We feel that the disease has advanced to the remaining portion of the gland in these patients, or that a stricture had formed at the anastomosis to the jejunum.

At first glance the finding of 12 patients out of 142 who had carcinoma of the pancreas where they were originally thought to have chronic pancreatitis, is considerably higher than reported by others. We have reviewed the protocols of all 12 patients in this series, including the methods of biopsy, and feel that, in view of the fact that each patient had not only 1 cc or larger pieces of involved pancreas submitted to the pathologist, but also regional lymph nodes obtained under direct vision, there was no other means at hand which could have provided a better diagnostic accuracy at surgery. This again points out the great difficulty of differentiating a carcinoma from chronic pancreatitis even at the operating table. All of the patients in this group with carcinoma have been subjected to pancreaticojejunostomy. The question arises as to whether chronic pancreatitis increases the rate of pancreatic carcinoma, either secondary to chronic inflammation or because of the presence of some carcinogens. That cannot be answered on the basis of this study. We were not, however, able to detect malignancies in adjacent organs in these patients, and the cancers became manifested in the early rather than in the late postoperative period. Because we found so many carcinomas, we now prefer to perform an 80–95% pancreatectomy in older patients who have an atypical growth pancreatic morphology, in which group the chances of finding a previously undetected pancreatic carcinoma are greater. With this approach we have resected three patients in the past three years who had diffuse calcification of the pancreas thought initially to be on the basis of chronic pancreatitis alone, and found carcinomas, with the result that two of the three patients are without evidence of disease three years postoperative.

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